

MARCH 11, 2011 JAPAN EARTHQUAKE AND TSUNAMI

Updated: August 18, 2011 at 20:00 UTC, 02:00 pm MDT

The 11 March 2011 magnitude 9.1 Honshu, Japan earthquake (38.297 N, 142.373 E, depth 29 km) generated a tsunami that was observed all over the Pacific region and caused tremendous devastation locally*. This is the fourth largest earthquake in the world and the largest in Japan since instrumental recordings began in 1900. The IOC/UNESCO reports that as of August 18, 2011, there are 15,647 deaths and 4,643 missing in Japan. This is the deadliest tsunami since the 2004 magnitude 9.1 Sumatra earthquake and tsunami caused nearly 230,000 deaths and \$10 billion in damage. This is the most devastating earthquake to occur in Japan since the 1995 Kobe earthquake caused over 5,500 deaths and the deadliest tsunami since the 1993 Hokkaido earthquake generated a tsunami which was responsible for over 200 deaths.

MARCH 11, 2011 EYEWITNESS AND INSTRUMENTAL RECORDINGS

Field survey results indicate the highest runup height was 56 meters (tide removed) in Iwate Prefecture (39.3175 N, 141.9725 E) (<http://www.coastal.jp/tsunami2011/>). Runup is the difference between the elevation of maximum tsunami penetration (inundation line) and the sea level at the time of the tsunami. Tide gauge recordings in Japan range from 1 to 7 meters. Three meter waves were observed by eyewitnesses in the Kuril Islands, Russia. Two meter waves were observed at tide gauges in South America, Hawaii, and the west coast of the United States. The highest wave ever recorded by an ocean-bottom sensor was measured at 1.4 meters (1/2 peak-to-trough) by DART® station 21418 located 450 nautical miles northeast of Tokyo (see display on p. 4). NGDC will continue to update the historic tsunami database as eyewitness and field survey reports are received.

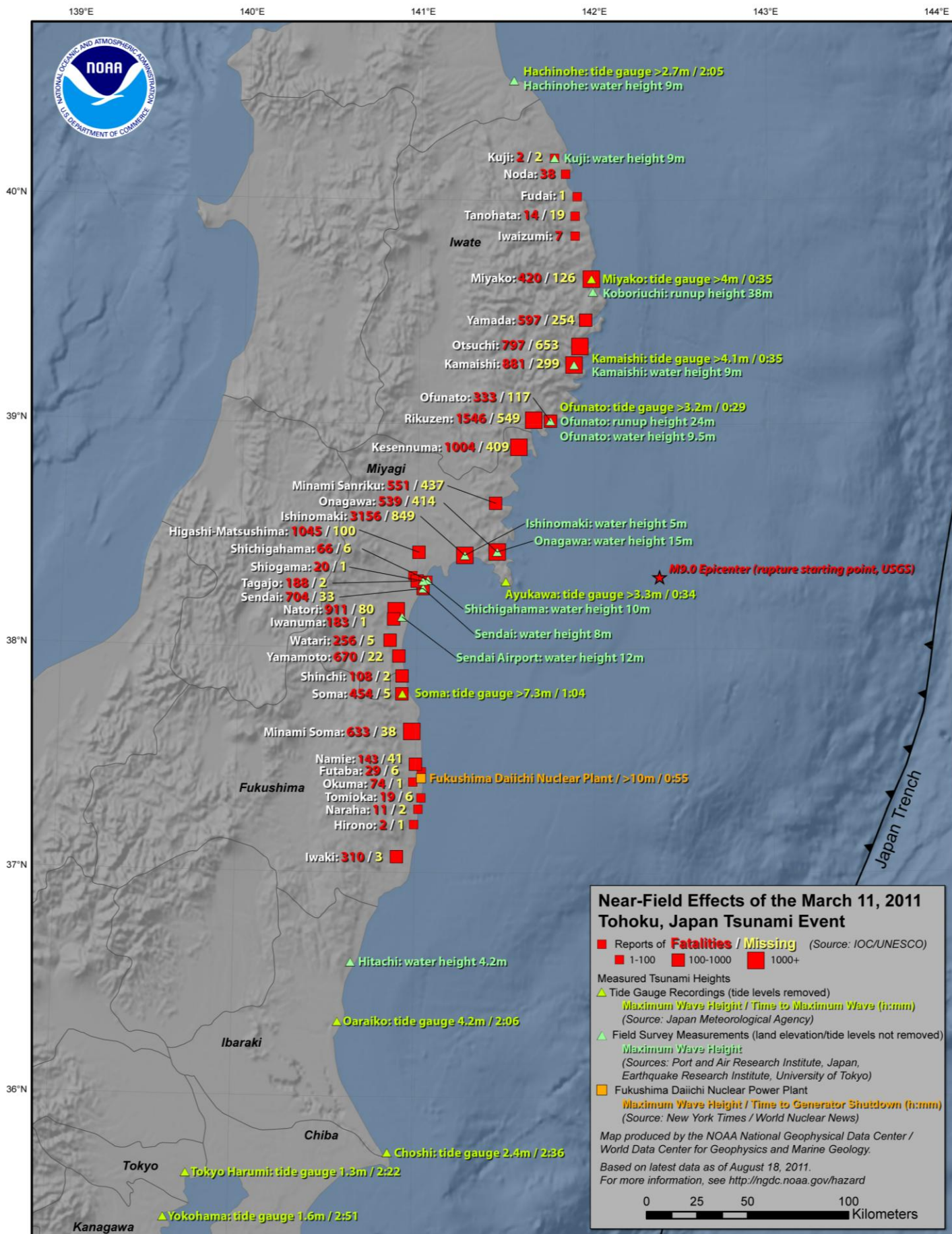
HISTORICAL EARTHQUAKES AND TSUNAMIS IN JAPAN

According to the NOAA National Geophysical Data Center / World Data Center for Marine Geology and Geophysics / (<http://ngdc.noaa.gov/hazard>) Global Historical Event databases, 2,108 tsunamis (validity $\geq 1^+$) have occurred in the world since 2000 B.C. and 279 (13%) of these tsunamis caused deaths. In the Japanese region, 306 tsunamis (validity $\geq 1^+$) have been observed since 684 A.D., and 76 (25%) of these events caused deaths. The majority of Japanese tsunamis were generated by earthquakes (87%), the remainder resulted from volcanic eruptions (5%) and unknown causes (8%). The most fatal Japanese earthquakes and tsunamis are listed below:

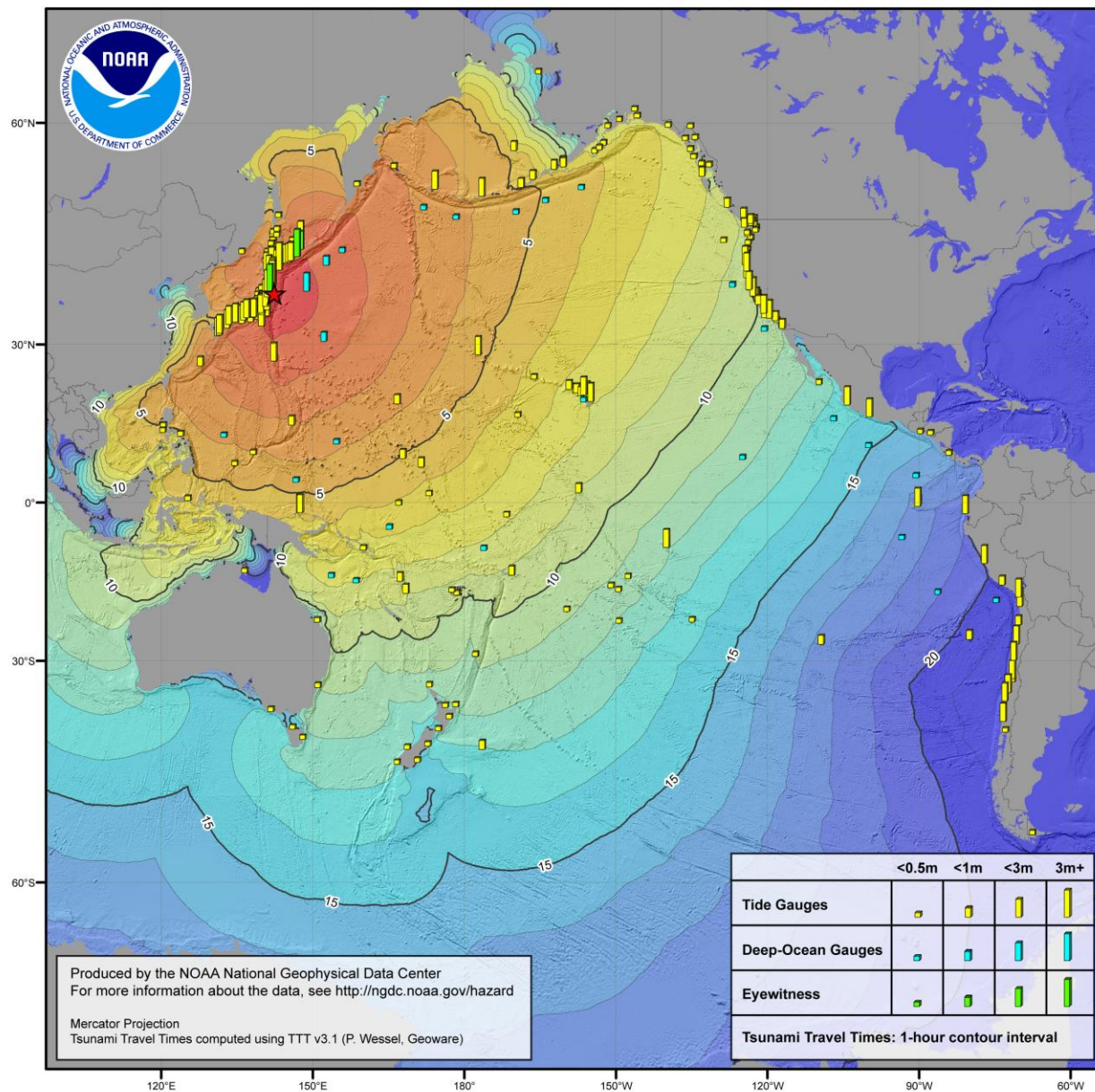
- 1293 Kamakura earthquake caused **23,024 deaths** and generated a small tsunami
- 1498 Enshunada Sea earthquake-generated tsunami caused **31,000 deaths**
- 1586 Ise Bay earthquake and tsunami caused over **8,000 deaths**
- 1771 Ryukyu Islands earthquake-generated tsunami caused over **13,000 deaths**
- 1792 Mt. Unzen eruption generated a tsunami. The eruption and tsunami caused over **15,000 deaths**
- 1847 Zenkoji earthquake caused **12,000 deaths**
- 1855 Tokyo earthquake caused **6,757 deaths** and generated a small tsunami
- 1891 Mino-Owari earthquake caused **7,273 deaths**
- 1896 Sanriku earthquake and tsunami caused over **27,000 deaths**
- 1923 Sagami Gulf earthquake caused over **99,000 deaths** and generated a tsunami that caused over **2,000 deaths**
- 1995 Kobe earthquake caused **5,502 deaths** and generated a small tsunami

* Data are collected from the US NOAA National Weather Service Tsunami Warning Centers, the US Geological Survey National Earthquake Information Center, the US NOAA National Data Buoy Center, IOC/UNESCO and news organizations. Refer to the NGDC event page for data and their sources (http://ngdc.noaa.gov/hazard/tsu_db.shtml).

⁺ A validity score or confidence designation is assigned to each tsunami event ranging from -1 for erroneous entries to 4 for definite or confirmed tsunamis.



March 11, 2011 Tsunami Event: Observed Water Heights and Computed Tsunami Travel Times



DART 21418 – 450 NM NE of Tokyo, Japan (38.711 N, 148.694 E) Processed data and plot
(http://www.ngdc.noaa.gov/hazard/tsunami/pdf/21418_data.JPG)

